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(54) **EXCHANGING DATA BASED UPON DEVICE PROXIMITY AND CREDENTIALS**

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(51) **Int. Cl.**

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| ***H04W 12/04*** | (2009.01) |
| ***H04W 12/06*** | (2009.01) |
| *H04B 5/00* | (2006.01) |
| *H04W 84/12* | (2009.01) |
| *H04W 84/18* | (2009.01) |
| *H04W 92/18* | (2009.01) |
| *H04L 29/06* | (2006.01) |

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(58) **Field of Classification Search**

USPC ................. 455/41.1–41.3, 456.1, 518, 550.1, 455/552.1, 554.2, 556.1, 560; 713/155, 713/300; 726/19, 17; 370/328–329, 370/252–254, 401; 705/66, 35, 67, 44, 71

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 7,657,255 | B2 | 2/2010 | Abel et al. | |
| 8,385,822 | B2 | 2/2013 | Chatterjee | |
| 2002/0013831 | A1* | 1/2002 | Astala et al. | 709/220 |
| 2003/0228842 | A1* | 12/2003 | Heinonen et al. | 455/41.2 |
| 2005/0021940 | A1* | 1/2005 | Ma | 713/155 |
| 2005/0266798 | A1* | 12/2005 | Moloney et al. | 455/41.2 |
| 2006/0068785 | A1* | 3/2006 | Kamijo et al. | 455/435.1 |
| 2006/0126531 | A1* | 6/2006 | Myojo et al. | 370/252 |
| 2006/0143705 | A1* | 6/2006 | Sentoff | 726/19 |
| 2007/0124809 | A1* | 5/2007 | Narin et al. | 726/6 |
| 2007/0234432 | A1* | 10/2007 | Korkishko et al. | 726/27 |
| 2008/0117117 | A1* | 5/2008 | Washiro | 343/850 |
| 2008/0151847 | A1 | 6/2008 | Abujbara | |
| 2009/0094681 | A1 | 4/2009 | Sadler et al. | |
| 2009/0111378 | A1* | 4/2009 | Sheynman et al. | 455/41.1 |
| 2009/0198618 | A1* | 8/2009 | Chan et al. | 705/66 |

(Continued)

OTHER PUBLICATIONS

iPhone 5 Will Enable Ambitious Remote Computing Program—Source [Exclusive]; http://www.cultofmac.com/iphone-5-will-enable-ambitious-remote-computing/66825 ; Kahney, L.; Nov. 1, 2010.

(Continued)

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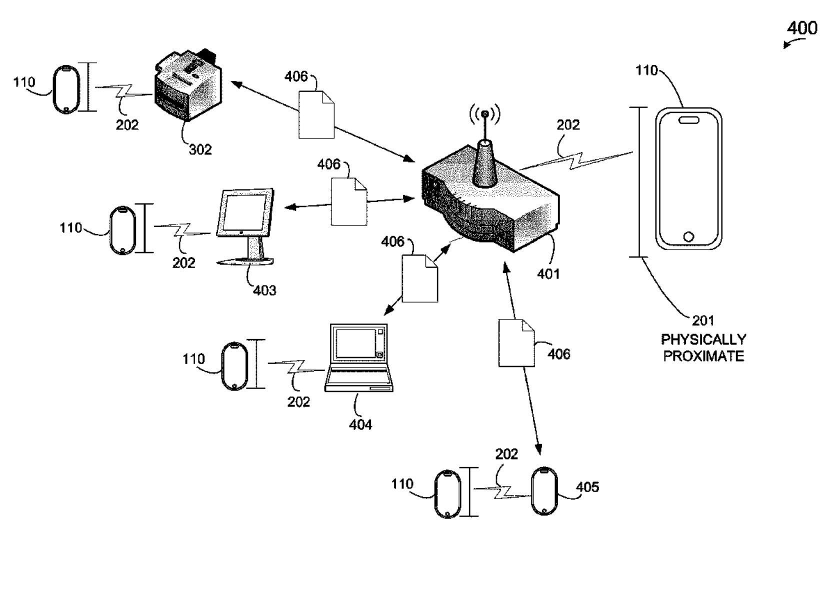
*Assistant Examiner* — Cindy Trandai
(74) *Attorney, Agent, or Firm* — Norton Rose Fulbright US LLP

(57) **ABSTRACT**

Illustrated is a system and method to transmit a credential to a proximate first device, the first device validating the credential. The system and method also includes transmitting data to the first device. The system and method also includes transmitting the credential to a proximate second device, the second device validating the credential and to receive the data from the first device.

**24 Claims, 11 Drawing Sheets**



(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 2010/0043056 | A1* | 2/2010 | Ganapathy | 726/2 |
| 2010/0082784 | A1 | 4/2010 | Rosenblatt et al. | |
| 2010/0083012 | A1* | 4/2010 | Corbridge et al. | 713/300 |
| 2010/0180063 | A1 | 7/2010 | Ananny et al. | |
| 2010/0218249 | A1 | 8/2010 | Wilson et al. | |
| 2010/0272030 | A1* | 10/2010 | Babbar | 370/329 |
| 2010/0290390 | A1* | 11/2010 | Souissi et al. | 370/328 |
| 2011/0047609 | A1 | 2/2011 | Tetsuhashi | |
| 2011/0076948 | A1* | 3/2011 | Jabara et al. | 455/41.2 |
| 2011/0294502 | A1* | 12/2011 | Oerton | 455/426.1 |
| 2011/0314530 | A1* | 12/2011 | Donaldson | 726/7 |

OTHER PUBLICATIONS

Remote Computing in Iphone, NFC and Mac App Store; http://weeble.net/nfc-equipped-iphone/2622/ ; Chezz; Mar. 18, 2011.

iPhone 5 Will Enable Ambitious Remote Computing Program—Source [Exclusive]; http://www.cultofmac.com/iphone-5-will-enable-ambitious-remote-computing/66825; Kahney. L.: Nov. 1, 2010.

Remote Computing in Iphone, NFC and Mac App Store; http://weeble.net/nfc-equipped-iphone/2622/; CHEZZ; Mar. 18, 2011.

* cited by examiner

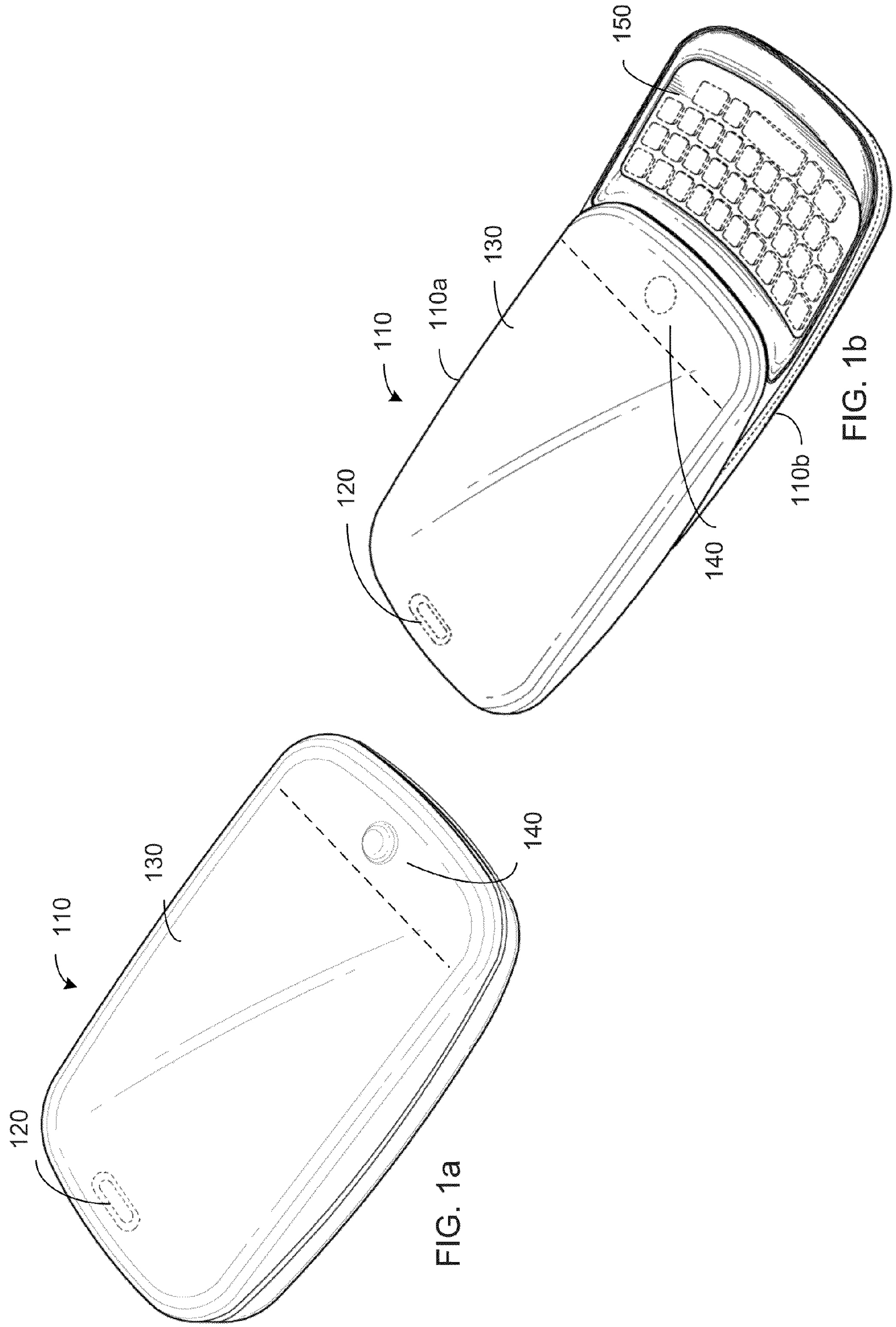



FIG. 1b

FIG. 1a

FIG. 1

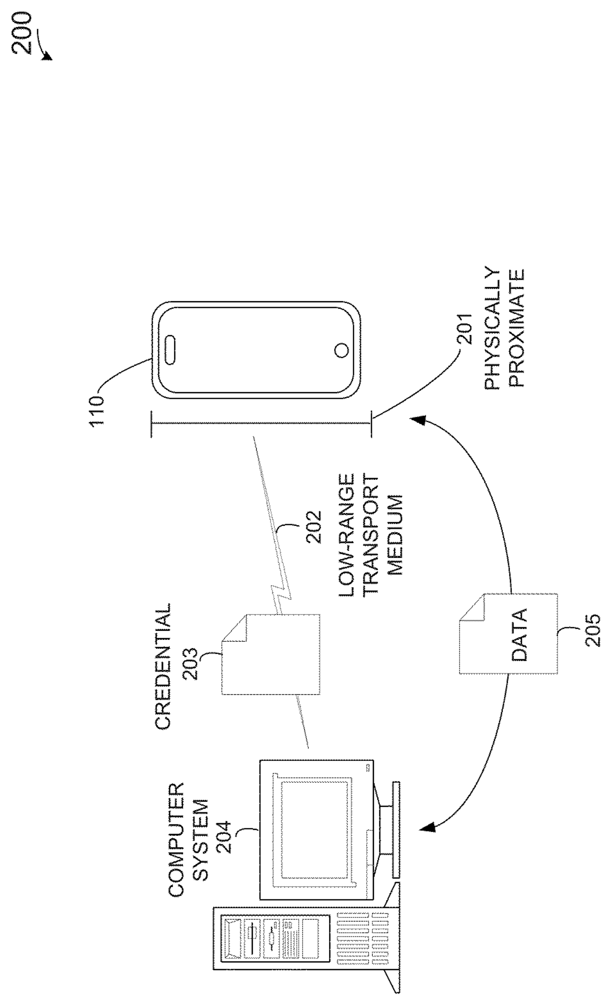

200
110
201
PHYSICALLY
PROXIMATE
LOW-RANGE
TRANSPORT
MEDIUM
202
CREDENTIAL
203
DATA
205
COMPUTER
SYSTEM
204

FIG. 2

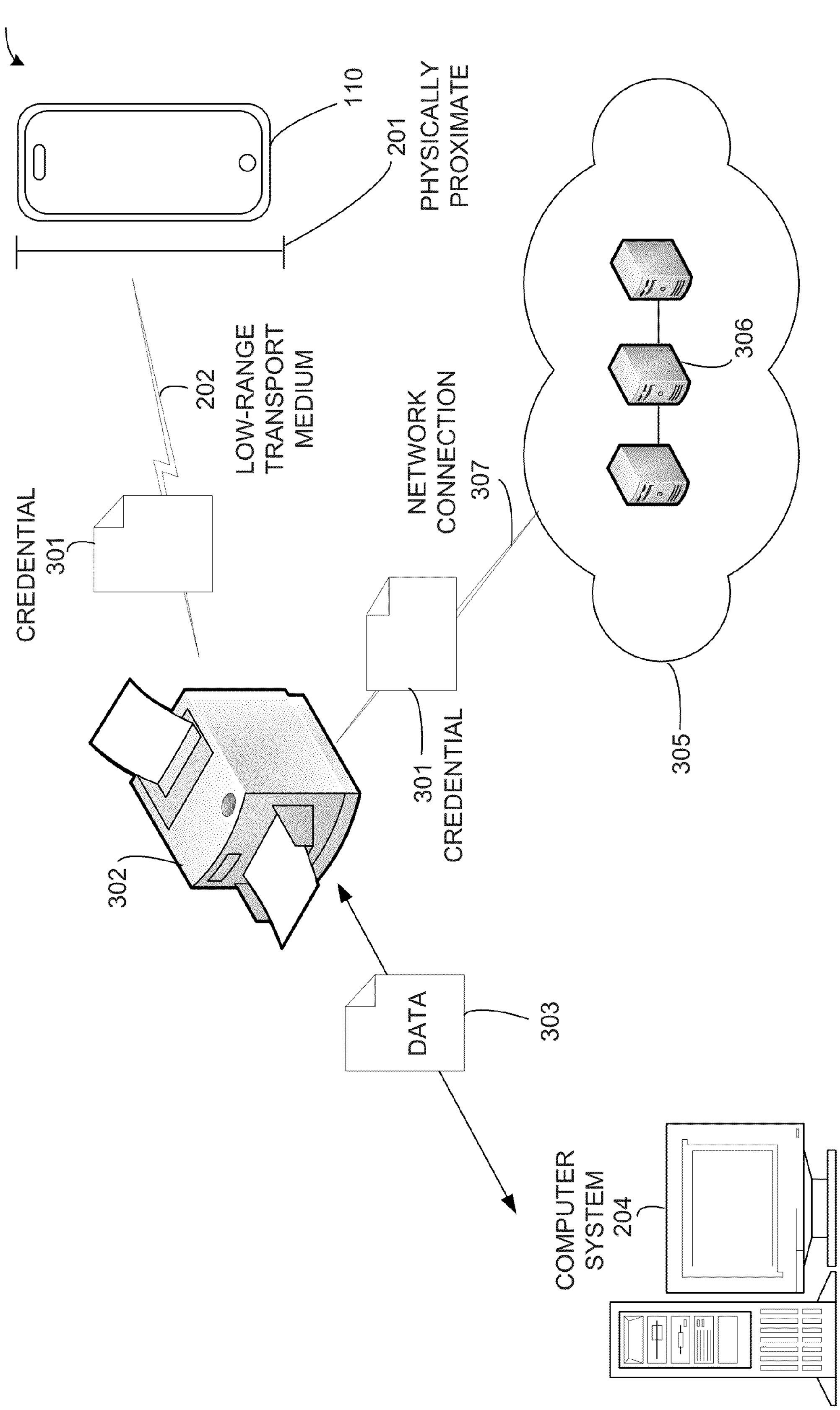

300
110
201
PHYSICALLY PROXIMATE
202
LOW-RANGE TRANSPORT MEDIUM
CREDENTIAL 301
NETWORK CONNECTION 307
306
305
301 CREDENTIAL
302
DATA
303
COMPUTER SYSTEM 204

FIG. 3

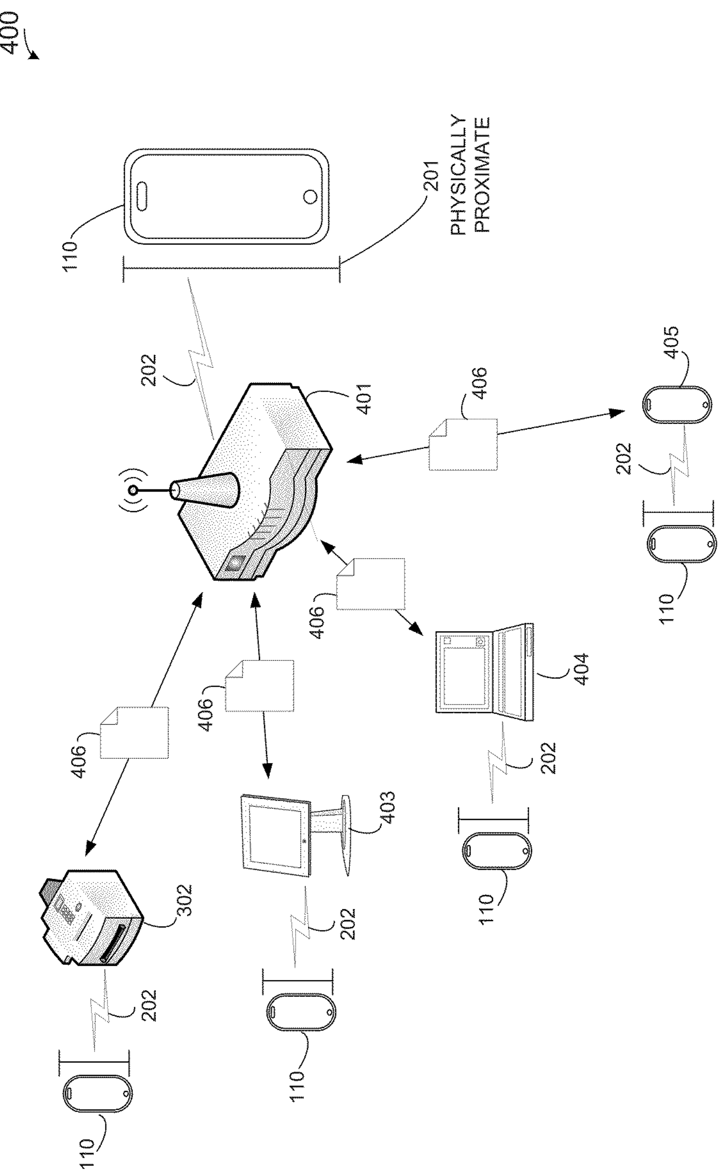



FIG. 4

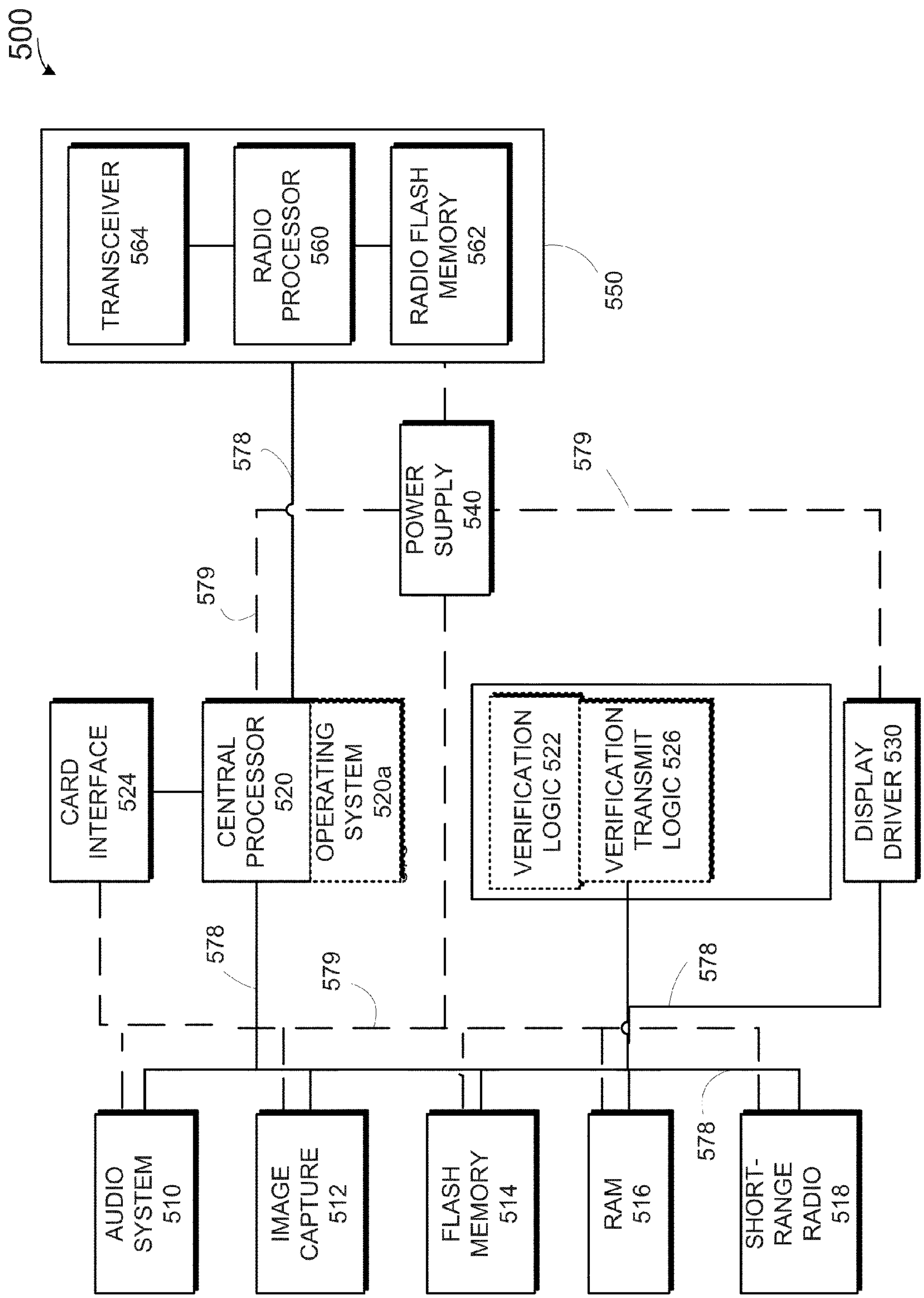

500
TRANSCEIVER 564
RADIO PROCESSOR 560
RADIO FLASH MEMORY 562
550
578
579
POWER SUPPLY 540
CARD INTERFACE 524
CENTRAL PROCESSOR 520
OPERATING SYSTEM 520a
VERIFICATION LOGIC 522
VERIFICATION TRANSMIT LOGIC 526
DISPLAY DRIVER 530
AUDIO SYSTEM 510
IMAGE CAPTURE 512
FLASH MEMORY 514
RAM 516
SHORT-RANGE RADIO 518

FIG. 5

FIG. 6

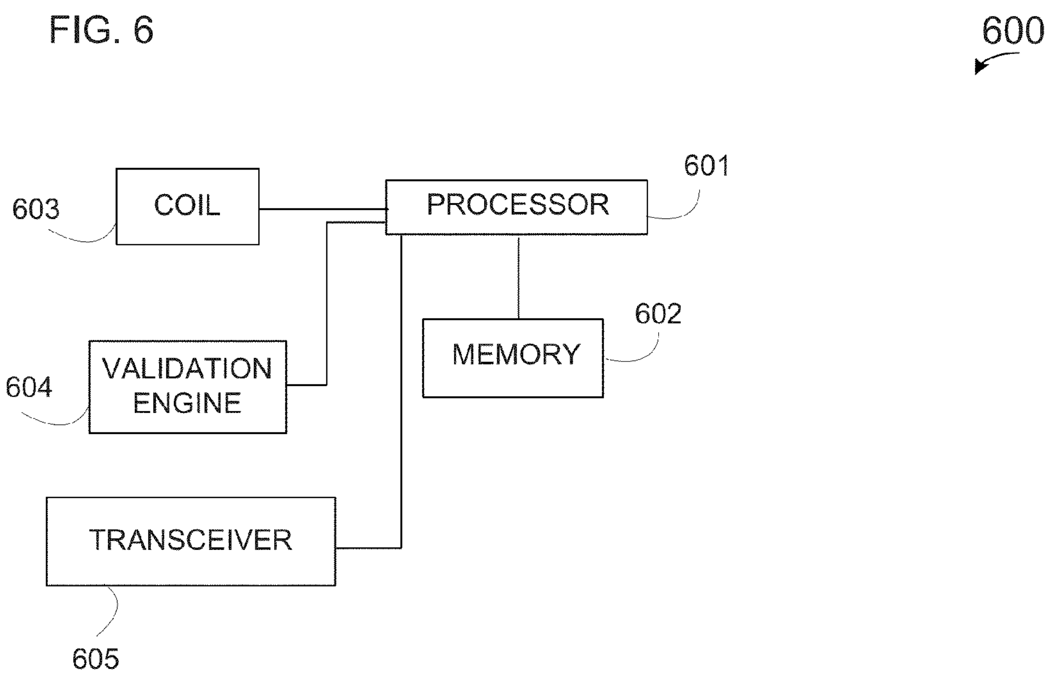

600
COIL
603
PROCESSOR
601
MEMORY
602
VALIDATION ENGINE
604
TRANSCEIVER
605

FIG. 7

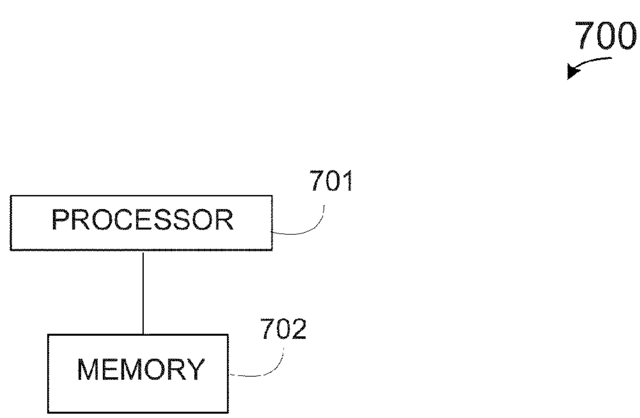

700
PROCESSOR
701
MEMORY
702

FIG. 8

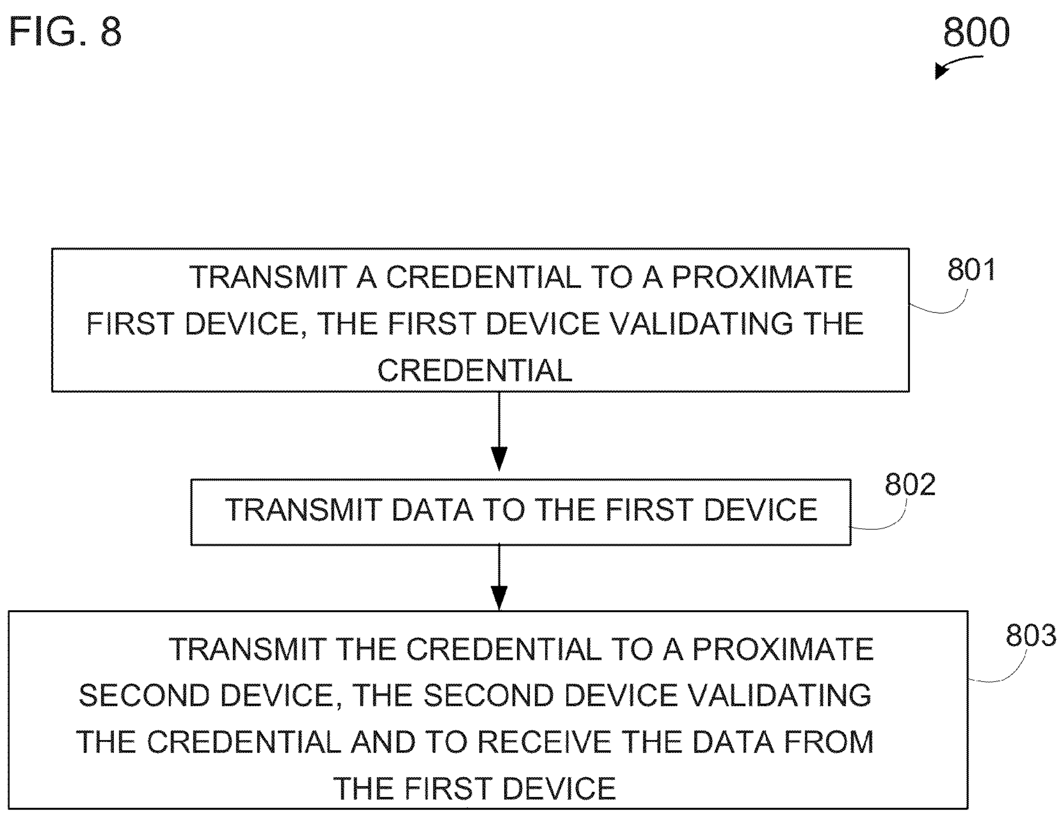
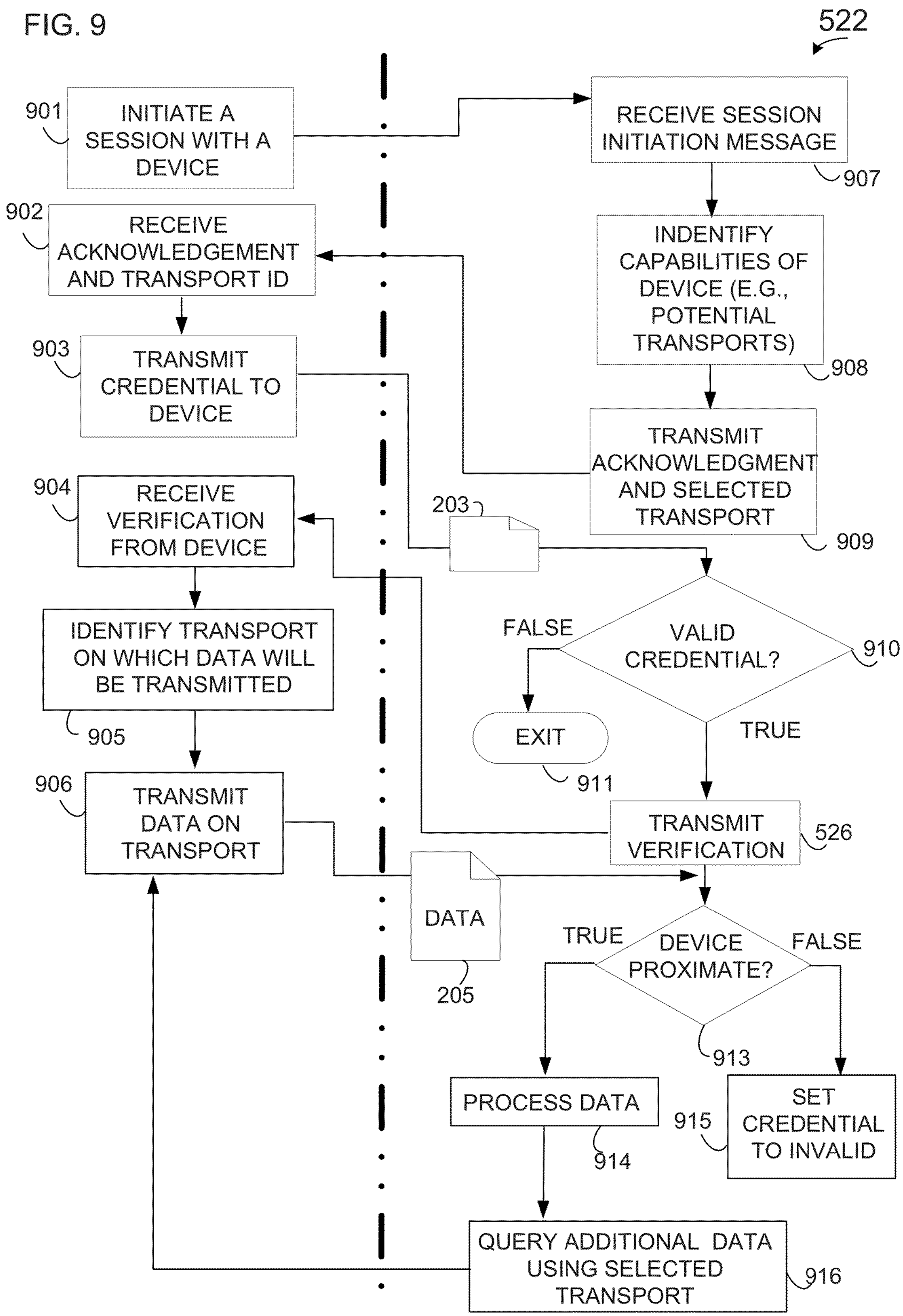

800
TRANSMIT A CREDENTIAL TO A PROXIMATE FIRST DEVICE, THE FIRST DEVICE VALIDATING THE CREDENTIAL
801
TRANSMIT DATA TO THE FIRST DEVICE
802
TRANSMIT THE CREDENTIAL TO A PROXIMATE SECOND DEVICE, THE SECOND DEVICE VALIDATING THE CREDENTIAL AND TO RECEIVE THE DATA FROM THE FIRST DEVICE
803

FIG. 9


522
901
INITIATE A SESSION WITH A DEVICE
RECEIVE SESSION INITIATION MESSAGE
907
902
RECEIVE ACKNOWLEDGEMENT AND TRANSPORT ID
INDENTIFY CAPABILITIES OF DEVICE (E.G., POTENTIAL TRANSPORTS)
908
903
TRANSMIT CREDENTIAL TO DEVICE
TRANSMIT ACKNOWLEDGMENT AND SELECTED TRANSPORT
909
904
RECEIVE VERIFICATION FROM DEVICE
203
VALID CREDENTIAL?
910
FALSE
TRUE
EXIT
911
IDENTIFY TRANSPORT ON WHICH DATA WILL BE TRANSMITTED
905
906
TRANSMIT DATA ON TRANSPORT
TRANSMIT VERIFICATION
526
DATA
205
DEVICE PROXIMATE?
TRUE
FALSE
913
PROCESS DATA
914
915
SET CREDENTIAL TO INVALID
QUERY ADDITIONAL DATA USING SELECTED TRANSPORT
916

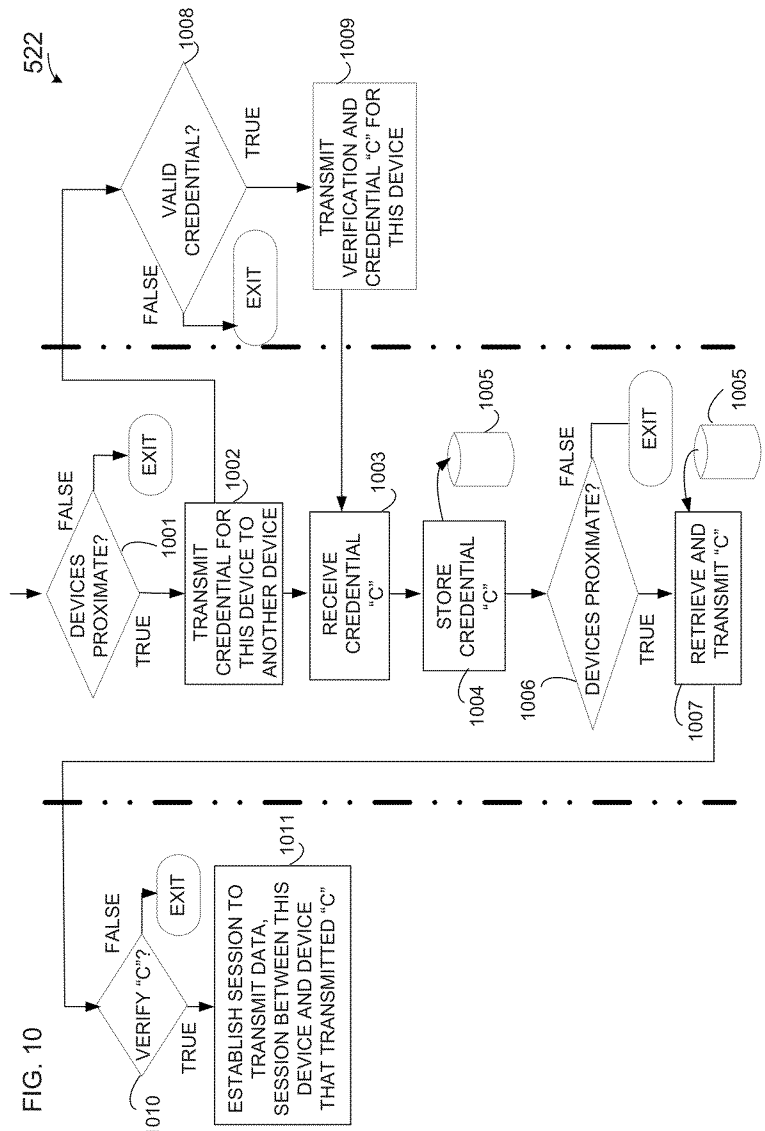

522
DEVICES PROXIMATE?
1001
FALSE
EXIT
TRUE
TRANSMIT CREDENTIAL FOR THIS DEVICE TO ANOTHER DEVICE
1002
VALID CREDENTIAL?
1008
FALSE
EXIT
TRUE
TRANSMIT VERIFICATION AND CREDENTIAL "C" FOR THIS DEVICE
1009
RECEIVE CREDENTIAL "C"
1003
STORE CREDENTIAL "C"
1004
1005
DEVICES PROXIMATE?
1006
FALSE
EXIT
TRUE
RETRIEVE AND TRANSMIT "C"
1007
1005
VERIFY "C"?
1010
FALSE
EXIT
TRUE
ESTABLISH SESSION TO TRANSMIT DATA, SESSION BETWEEN THIS DEVICE AND DEVICE THAT TRANSMITTED "C"
1011

FIG. 10

FIG. 11

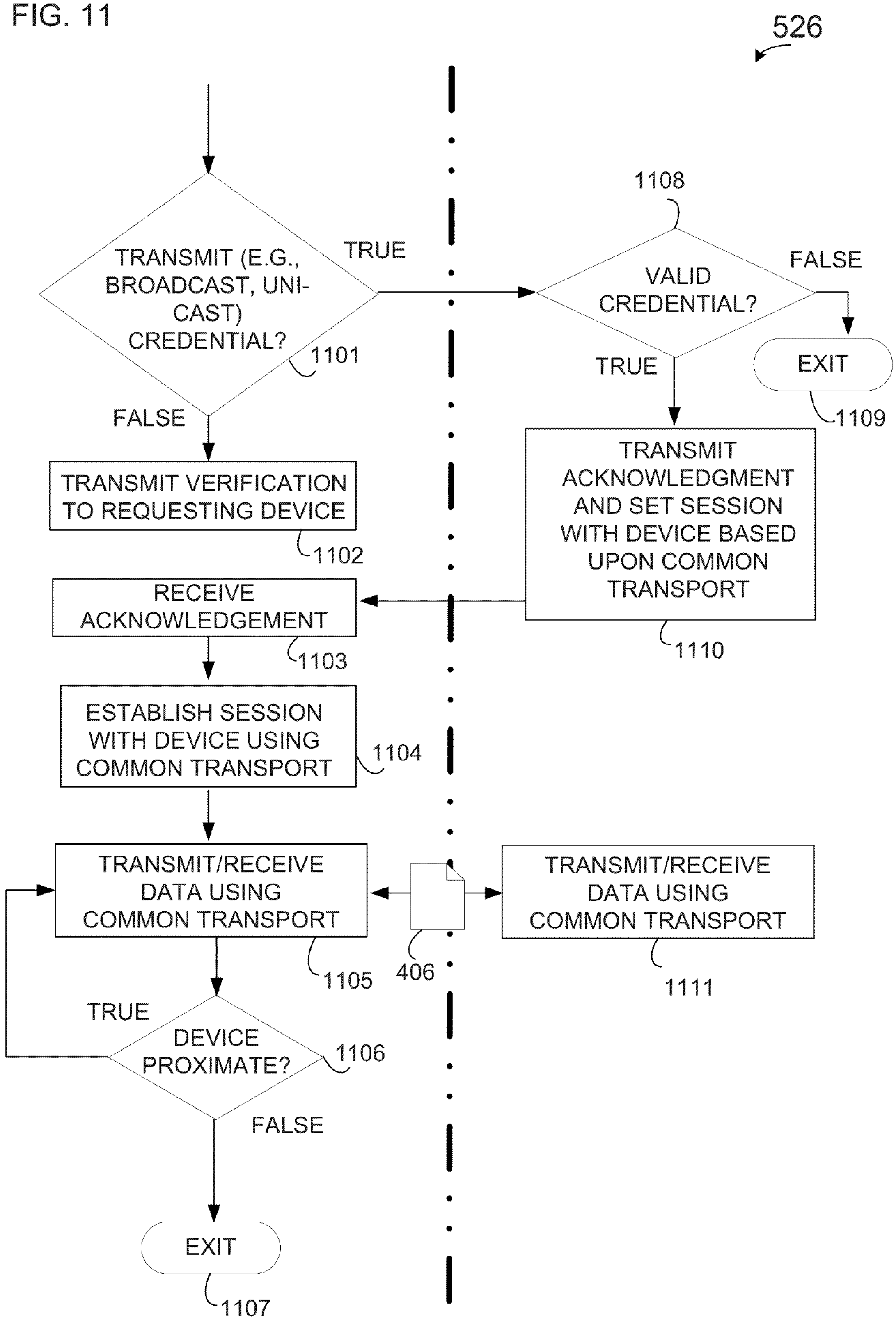
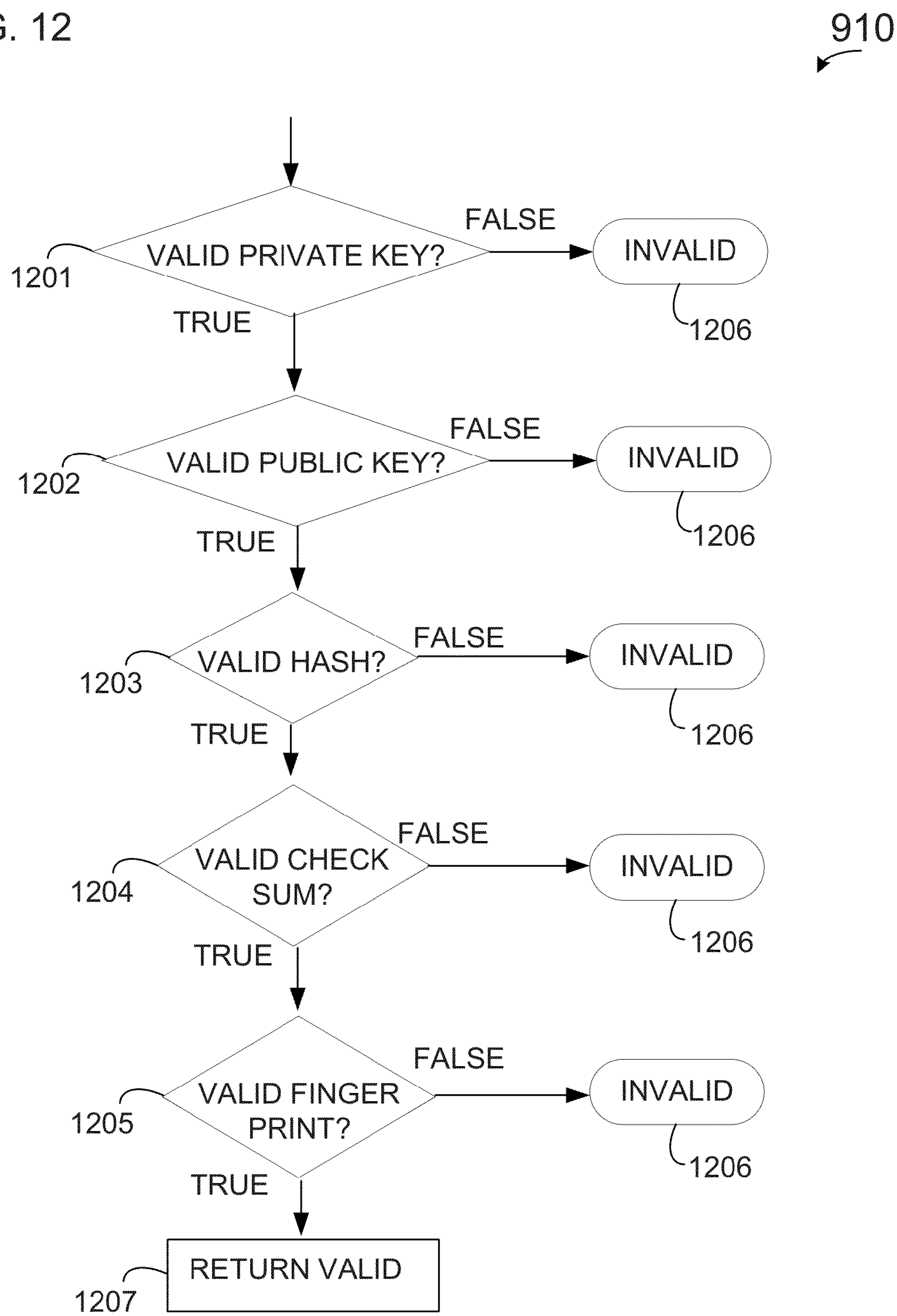

526
TRANSMIT (E.G., BROADCAST, UNI-CAST) CREDENTIAL?
1101
TRUE
FALSE
TRANSMIT VERIFICATION TO REQUESTING DEVICE
1102
RECEIVE ACKNOWLEDGEMENT
1103
ESTABLISH SESSION WITH DEVICE USING COMMON TRANSPORT
1104
TRANSMIT/RECEIVE DATA USING COMMON TRANSPORT
1105
406
DEVICE PROXIMATE?
1106
TRUE
FALSE
EXIT
1107
1108
VALID CREDENTIAL?
FALSE
EXIT
1109
TRUE
TRANSMIT ACKNOWLEDGMENT AND SET SESSION WITH DEVICE BASED UPON COMMON TRANSPORT
1110
TRANSMIT/RECEIVE DATA USING COMMON TRANSPORT
1111

FIG. 12


910
VALID PRIVATE KEY?
FALSE
INVALID
1201
TRUE
1206
VALID PUBLIC KEY?
FALSE
INVALID
1202
TRUE
1206
VALID HASH?
FALSE
INVALID
1203
TRUE
1206
VALID CHECK SUM?
FALSE
INVALID
1204
TRUE
1206
VALID FINGER PRINT?
FALSE
INVALID
1205
TRUE
1206
RETURN VALID
1207

# EXCHANGING DATA BASED UPON DEVICE PROXIMITY AND CREDENTIALS

## CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to U.S. patent application Ser. No. 12/478,766, filed Jun. 4, 2009, entitled INDUCTIVE SIGNAL TRANSFER SYSTEM FOR COMPUTING DEVICES; which is a continuation-in-part of U.S. patent application Ser. No. 12/239,656, filed Sep. 26, 2808, entitled ORIENTATION AND PRESENCE DETECTION FOR USE IN CONFIGURING OPERATIONS OF COMPUTING DEVICES IN DOCKED ENVIRONMENTS, which claims benefit of priority to the following applications: Provisional U.S. Patent Application No. 61/142,560, filed Jan. 5, 2009, entitled ELECTRICAL APPARATUS FOR REAL TIME WIRELESS POWER DELIVERY; Provisional U.S. Patent Application No. 61/142,194, filed Dec. 31, 2808, entitled PROTOCOL FOR REAL TIME POWER AND ACCESSORY DATA CONNECTION; Provisional U.S. Patent Application No. 61/142,195, filed Jan. 1, 2009, entitled TECHNIQUES FOR MAGNETICALLY COUPLING CHARGING CIRCUITS AND DEVICES; Provisional U.S. Patent Application No. 61/142,602, filed Jan. 5, 2009, entitled MAGNETIC CLASP WITH MULTIPLE ORIENTATIONS AND ORIENTATION DETECTION; all of the aforementioned priority applications being hereby incorporated by reference in their entirety.

## BACKGROUND

Authentication can be implemented via a variety of methods including those that utilize the following: symmetric keys, asymmetric keys, hashing, or a check sum value. Authentication can be used to identify a user, a device, to facilitate payment, or for a variety of other purposes. Some example technologies that are used in conjunction with an authentication regime are: Radio-frequency identification (RFID), BLUETOOTH™, and 802.11(a-n) (collectively known as "WiFi"). An authentication regime, as implemented by these technologies, includes the providing of one of the aforementioned keys from a first device to second device, the second device authenticating the first device based upon the providing of the correct key.

## BRIEF DESCRIPTION OF THE DRAWINGS

Some embodiments of the invention are described, by way of example, with respect to the following figures:

FIG. **1***a* illustrates one embodiment of a mobile computing device that is authenticated to an additional device, where authentication takes the form of placing the device in proximity to the additional device.

FIG. **1***b* illustrates one embodiment of a mobile computing device that is authenticated to an additional device, where authentication takes the form of placing the device in proximity to the additional device.

FIG. **2** is a diagram of a system, according to an example embodiment, used to authenticate the mobile computing device to a computer system for the purpose of data transfer.

FIG. **3** is a diagram of a system, according to an example embodiment, used to authenticate the mobile computing device to a printer and a network, where the printer, network, and computer system are part of a network.



FIG. **4** is a diagram of a system, according to an example embodiment, used to authenticate a mobile computing device to a network, where a plurality of devices communicate using a network device.

FIG. **5**, a block diagram illustrating an architecture, according to an example embodiment, of a mobile computing device enabled to be authenticated to a plurality of devices.

FIG. **6** is a block diagram of a system, according to an example embodiment, representing a network device used to transfer and receive data, to an additional device, where authentication takes the form of placing a mobile computing device in proxim to the network device.

FIG. **7** is a block diagram of a system, according to an example embodiment, representing a mobile computing device used to transfer and receive data to an additional device, where authentication takes the form of placing the device in proximity to the additional device.

FIG. **8** is a flow chart illustrating a method, according to an example embodiment, used to transfer and receive data, to/from an additional device, where authentication takes the form of placing the device in proximity to the additional device.

FIG. **9** is a dual-stream flowchart illustrating an execution, according to an example embodiment, of the verification logic module that facilitates the transfer and receiving of data, to/from a mobile computing device, where authentication takes the form of placing a mobile computing device in proximity to another device.

FIG. **10** is a tri-stream flowchart illustrating an execution of the verification logic module, according to an example embodiment, that facilitates the transfer and receiving of a credential amongst three devices.

FIG. **11** is a flow chart illustrating an execution, according to an example embodiment, of a verification transmit logic module.

FIG. **12** is a flow chart illustrating a method, according to an example embodiment, to execute operation to validate a credential.

## DETAILED DESCRIPTION

Illustrated is a system and method to authenticate a device, used to transfer and receive data, to an additional device, where authentication takes the form of placing the device in proximity to the additional device. Both the device and additional device may be part of a network, and at least one of the devices may include a coil and be capable of inductive charging and data transfer via a power channel and an inductive link. Inductive charging between proximate devices, where an inductive link exists between these devices, is described in U.S. patent application Ser. No. 12/621,087 filed on Nov. 19, 2009 and titled "PORTABLE POWER SUPPLY DEVICE FOR MOBILE COMPUTING DEVICES" and U.S. patent application Ser. No. 12/478,766, filed Jun. 4, 2009, entitled INDUCTIVE SIGNAL TRANSFER SYSTEM FOR COMPUTING DEVICES, both of which are incorporated by reference in their entirety. The device may be a mobile computing device as outlined below. Proximate may be within a range of 0-4 cm. Further, the authentication may take place over a low-range-transport medium that includes: the inductive link, RFID, BLUETOOTH™, or some other suitable transport medium.

In some example embodiments, a mobile computing device is proximate to an additional device such that the mobile computing device is authenticated to the additional device ("A"). This mobile computing device may be brought proximate to a further device ("B") such that the mobile computing device is authenticated to "B". The mobile computing device is able to transmit and receive data between "A" and "B", based upon its being authenticated to both "A" and "B". The data may be transported over some transport medium including: WiFi, System of Mobile (GSM) communication system, a Code Division Multiple Access (CDMA system), a Universal Mobile Telecommunications System (UNITS), OF some other suitable transport medium.

In some example embodiments, the authentication of the mobile computing device to "A" and "B" may cease where the mobile computing device is no longer proximate to "A" or "B". For example, if the mobile computing device is removed from proximity to "A", then the mobile computing, device may no longer be authenticated to "A", Similarly, if the mobile computing device is no longer within range of the "A" to use one of the above referenced transport mediums, the mobile computing device may no longer be authenticated to "A". The use of the range of the mobile computing device to "A" as a basis for continuing authentication may be referred to herein as non-persistent authentication. In some cases, a mobile computing device may have persistent authentication wherein once the mobile computing device is authenticated to "A", it continues to be authenticated irrespective of its proximity or range to "A".

FIG. **1***a* and **1***b* illustrate one embodiment of a mobile computing device **110** that is authenticated to an additional device, where authentication takes the form of placing the device in proximity to the additional device. FIG. **1***a* illustrates one embodiment of a first positional state of the mobile computing device **110** having telephonic functionality, e.g., a mobile phone or smartphone. FIG. **1***b* illustrates one embodiment of a second positional state of the mobile computing device **110** having telephonic functionality, e.g., a mobile phone, slate device, smartphone, netbook, or laptop computer. The mobile computing device **110** is configured to host and execute a phone application for placing and receiving telephone calls. In one example embodiment, the configuration as disclosed may be configured for use between a mobile computing device, that may be host device, and an accessory device.

It is noted that for ease of understanding the principles disclosed herein are in an example context of a mobile computing device **110** with telephonic functionality operating in a mobile telecommunications network. However, the principles disclosed herein may be applied in other duplex (or multiplex) telephonic contexts such as devices with telephonic functionality configured to directly interface with Public Switched Telephone Networks (PSTN) and/or data networks having Voice over Internet Protocol (VoIP) functionality. Likewise, the mobile computing device **110** is only by way of example, and the principles of its functionality apply to other computing devices, e.g., desktop computers, slate devices, server computers and the like.

The mobile computing device **110** includes a first portion **110***a* and a second portion **110***b*. The first portion **110***a* comprises a screen for display of information (or data) and may include navigational mechanisms. These aspects of the first portion **110***a* are further described below. The second portion **110***b* comprises a keyboard and also is further described below. The first positional state of the mobile computing device **110** may be referred to as an "open" position, in which the first portion **110***a* of the mobile computing device slides in a first direction exposing the second portion **110***b* of the mobile computing device **110** (or vice versa in terms of movement). The mobile computing device **110** remains operational in either the first positional state or the second positional state.

The mobile computing device **110** is configured to be of a form factor that is convenient to hold in a user's hand, for example, a Personal Digital Assistant (PDA) or a smart phone form factor. For example, the mobile computing device **110** can have dimensions ranging from 7.5 to 15.5 centimeters in length, 5 to 15 centimeters in width, 0.5 to 2.5 centimeters in thickness and weigh between 50 and 250 grams.

The mobile computing device **110** includes a speaker **120**, a screen **130**, and an optional navigation area **140** as shown in the first positional state. The mobile computing device **110** also includes a keypad **150**, which is exposed in the second positional state. The mobile computing device also includes a microphone (not shown). The mobile computing device **110** also may include one or more switches (not shown). The one or more switches may be buttons, sliders, or rocker switches and can be mechanical or solid state (e.g., touch sensitive solid state switch).

The screen **130** of the mobile computing device **110** is, for example, a 240×240, a 320×320, a 320×480, or a 640×480 touch sensitive (including gestures) display screen. The screen **130** can be structured from, for example, such as glass, plastic, thin-film or composite material. In one embodiment the screen may be 1.5 inches to 5.5 inches (or 4 centimeters to 14 centimeters) diagonally. The touch sensitive screen may be a transfective liquid crystal display (LCD) screen. In alternative embodiments, the aspect ratios and resolution may be different without departing from the principles of the inventive features disclosed within the description. By way of example, embodiments of the screen **130** comprises an active matrix liquid crystal display (AMLCD), a thin-film transistor liquid crystal display (TFT-LCD), an organic light emitting diode (OLED), an Active-matrix OLED (AMOLED), an interferometric modulator display (IMOD), a liquid crystal display (LCD), or other suitable display device. In an embodiment, the display displays color images. In another embodiment, the screen **130** further comprises a touch-sensitive display (e.g., pressure-sensitive (resistive), electrically sensitive (capacitive), acoustically sensitive (SAW or surface acoustic wave), photo-sensitive (infra-red)) including a digitizer for receiving input data, commands or information from a user. The user may use a stylus, a finger or another suitable input device for data entry, such as selecting from a menu or entering text data.

The optional navigation area **140** is configured to control functions of an application executing in the mobile computing device **110** and visible through the screen **130**. For example, the navigation area includes an x-way (x is a numerical integer, e.g., 5) navigation ring that provides cursor control, selection, and similar functionality. In addition, the navigation area may include selection buttons to select functions displayed through a user interface on the screen **130**. In addition, the navigation area also may include dedicated function buttons for functions such as, for example, a calendar, a web browser, an e-mail client or a home screen. In this example, the navigation ring may be implemented through mechanical, solid state switches, dials, or a combination thereof. In an alternate embodiment, the navigation area **140** may be configured as a dedicated gesture area, which allows for gesture interaction and control of functions and operations shown through a user interface displayed on the screen **130**.

The keypad area **150** may be a numeric keypad. (e.g., a dialpad) or a numeric keypad integrated with an alpha or alphanumeric keypad or character keypad **150** (e.g., a keyboard with consecutive keys of Q-W-E-R-T-Y, A-Z-E-R-T-Y, or other equivalent set of keys on a keyboard such as a DVORAK keyboard or a double-byte character keyboard).

Although not illustrated, it is noted that the mobile computing device **110** also may include an expansion slot. The expansion slot is configured to receive and support expansion cards (or media cards). Examples of memory or media card form factors include COMPACT FLASH, SD CARD, XD CARD, MEMORY STICK, MULTIMEDIA CARD, SDIO, and the like.

FIG. **2** is a diagram of a system **200** used to authenticate the mobile computing device **110** to a computer system **204** for the purpose of data transfer. Shown is a mobile computing device **110** that, as denoted at **201**, is physically proximate to the computer system **204**. Where the mobile computing device **110** is physically proximate to the computer system **204**, a credential **203** to transmitted along a low-range transport medium **202** to the computer system **204**. The credential **203** may include: a symmetric key, an asymmetric key, a hash value, a digital representation of a finger print, or a value to be used in a check sum calculation. In cases where the mobile computing device **110** is authenticated to the computer system **204**, data **205** may be exchanged between the mobile computing device **110** and the computer system **204**. As discussed above, the authentication may be persistent or non-persistent.

FIG. **3** is a diagram of a system **300** used to authenticate the mobile computing device to a printer **302** and a network **305**, where the printer **302**, network **305**, and computer system **204** are part of a network. As illustrated, the mobile computing device **110** is authenticated to the printer **302** using a credential **301** transmitted over the low-range transport medium **202**. The credential **301** may include: a symmetric key, an asymmetric key, a hash value, or a value to be used in a check sum calculation. Where the credential **301** successfully authenticates the mobile computing device **110** to the printer **302**, the credential **301** may be transmitted across the network connection **307** to the network **305** by the printer **302**. The network **305** may include a plurality of devices **306** that may exchange data with the printer **302** based upon the authentication of the mobile computing device **110** based upon the credential **301**. The plurality of devices **306** may include a web server, application server, and database server, where this combination is used to operate a website. This website may be a social networking website, wherein one or more profiles for the user of the mobile computing device **110** are stored. Example social network websites include: FACEBOOK™, LINKEDIN™, or MYSPACE™. In one example embodiment, data in the form of a profile is transmitted to the printer **302** by the devices that make up the website, where the credential **301** is received an authenticated by one of the plurality of devices **306**. In some example embodiments, data **303** is exchanged between the computer system **204** and the printer **302**, where the mobile computing device **110** is authenticated to both the computer system **204** and the printer **302**.

FIG. **4** is a diagram of an example system **400** used to authenticate a mobile computing device **110** to a network, where a plurality of devices communicate using a network device. Shown is a network device in the form of a wireless router **401**. Some example embodiments, the network device is a wireless access point, switch, or bridge. Using the low-range transport medium **202**, the mobile computing device **110** is authenticated to the wireless router **401** via the providing of a credential (not pictured) to the wireless router **401**. As shown, this mobile computing device **110** may also be authenticated to a monitor **403**, laptop computer **404**, and additional mobile computing device **405**. Where authentication has occurred, data **406** may be transmitted by one more of the devices (e.g., the monitor **403**, the laptop computer **404**, of the additional mobile computing device **405**) using wireless router **401**. For example, the data **406** may be transmitted from the mobile computing device **110** to the monitor **403**, and from the monitor **403** to the wireless router **401**, where the mobile computing device **110** has been authenticated to both the monitor **403** and the wireless router **401**. Instances where the mobile computing device **110** has been authenticated include those where, as depicted, the mobile computing device **110** has been proximate to the monitor **403**, laptop computer **404**, printer **302**, and additional mobile computing device **405**.

Referring next to FIG. **5**, a block diagram illustrates an example architecture of a mobile computing device **110**, enabled to be authenticated to a plurality of devices. By way of example, the architecture illustrated in FIG. **5** will be described with respect to the mobile computing device of FIG. **1***a*, **1***b*, **3**, **4**, or **5**. The mobile computing device **110** includes a central processor **520**, a power supply **540**, and a radio subsystem **550**. Examples of a central processor **520** include processing chips and system based on architectures such as ARM (including cores made by microprocessor manufacturers), ARM XSCALE, QUALCOMM SNAPDRAGON, AMD ATHLON, SEMPRON or PHENOM, INTEL ATOM, XSCALE, CELERON, CORE, PENTIUM or ITANIUM, IBM CELL, POWER ARCHITECTURE, SUN SPARC and the like.

The central processor **520** is configured for operation with a computer operating system **520***a*. The operating system **520***a* is an interface between hardware and an application, with which a user typically interfaces. The operating system **520***a* is responsible for the management and coordination of activities and the sharing of resources of the mobile computing device **110**. The operating system **520***a* provides a host environment for applications that are run on the mobile computing device **110**. As a host, one of the purposes of an operating system is to handle the details of the operation of the mobile computing device **110**. Examples of an operating system include PALM OS and WEBOS, MICROSOFT WINDOWS (including WINDOWS 7, WINDOWS CE, and WINDOWS MOBILE), SYMBIAN OS, RIM BLACKBERRY OS, APPLE OS (including MAC OS and IPHONE OS), GOOGLE ANDROID, and LINUX.

The central processor **520** communicates with an audio system **510**, an image capture subsystem (e.g., camera, video or scanner) **512**, flash memory **514**, RAM memory **516**, and a short range radio module **518** (e.g., Bluetooth, Wireless Fidelity (WiFi) component (e.g., IEEE 802.11, 802.20, 802.15, 802.16)). The central processor **520** communicatively couples these various components or modules through a data line (or bus) **578**. The power supply **540** powers the central processor **520**, the radio subsystem **550** and a display driver **530** (which may be contact- or inductive-sensitive). The power supply **540** may correspond to a direct current source (e.g., a battery pack, including rechargeable) or an alternating current (AC) source. The power supply **540** powers the various components through a power line (or bus) **579**. The power supply **540** may include at least one coil to facilitate inductive charging and data transfer.

The central processor communicates with applications executing within the mobile computing device **110** through the operating system **520***a*. In addition, intermediary components, for example, a verification logic module **522** and a verification transmit logic module **526**, provide additional communication channels between the central processor **520** and operating system **520** and system components, for example, the display driver **530**.

It is noted that in one embodiment, central processor **520** executes logic (e.g., by way of programming, code, or instructions) corresponding to executing applications interfaced through, for example, the navigation area **140** or switches. It is noted that numerous other components and variations are possible to the hardware architecture of the computing device **500**, thus an embodiment such as shown by FIG. **5** is just illustrative of one implementation for an embodiment.

The radio subsystem **550** includes a radio processor **560**, a radio memory **562**, and a transceiver **564**. The transceiver **564** may be two separate components for transmitting and receiving signals or a single component for both transmitting and receiving signals. In either instance, it is referenced as a transceiver **564**. The receiver portion of the transceiver **564** communicatively couples with a radio signal input of the device **110**, e.g., an antenna, where communication signals are received from an established call (e.g., a connected or on-going call). The received communication signals include voice (or other sound signals) received from the call and processed by the radio processor **560** for output through the speaker **120**. The transmitter portion of the transceiver **564** communicatively couples a radio signal output of the device **110**, e.g., the antenna, where communication signals are transmitted to an established (e.g., a connected (or coupled) or active) call. The communication signals for transmission include voice, e.g., received through the microphone of the device **110**, (or other sound signals) that is processed by the radio processor **560** for transmission through the transmitter of the transceiver **564** to the established call.

In one embodiment, communications using the described radio communications may be over a voice or data network. Examples of voice networks include GSM communication system, a CDMA system, and UMTS. Examples of data networks include General Packet Radio Service (GPRS), third-generation (3G) mobile (or greater), High Speed Download Packet Access (FISDPA), High Speed Uplink Packet Access (HSUPA), and Worldwide Interoperability for Microwave Access (WiMAX).

White other components may be provided with the radio subsystem **550**, the basic components shown provide the ability for the mobile computing device to perform radio-frequency communications, including telephonic communications. In an embodiment, many, if not all, of the components under the control of the central processor **520** are not required by the radio subsystem **550** when a telephone call is established, e.g., connected or ongoing. The radio processor **560** may communicate with central processor **520** using the data line (or bus) **578**.

The card interface **524** is adapted to communicate, wirelessly or wired, with external accessories (or peripherals), for example, media cards inserted into the expansion slot (not shown). The card interface **524** transmits data and/or instructions between the central processor and an accessory, e.g., an expansion card or media card, coupled within the expansion slot. The card interface **524** also transmits control signals from the central processor **520** to the expansion slot to configure the accessory. It is noted that the card interface **524** is described with respect to an expansion card or media card; it also may be structurally configured to couple with other types of external devices for the device **110**, for example, an inductive charging station for the power supply **540** or a printing device.

FIG. **6** is a block diagram of an example system **600** representing a network device used to transfer and receive data, to an additional device, where authentication takes the form of placing a mobile computing device in proximity to the network device. The various blocks shown herein may be implemented in software, hardware, or firmware. These blocks may be operatively connected, where operatively connected includes a physical or logical connection. Shown is a processor **601** operatively connected to a memory **602**. Operatively coupled to the processor **601** is a coil **603** to establish an inductive link between a mobile computing device and the network device. Operatively coupled to the processor **601** is a validation engine **604** to validate a credential received via the inductive link. Operatively coupled to the processor **601** is a transceiver **605** to transmit data where the credential is validated. In some example embodiments, the network device includes at least one of a router, a wireless access point, a switch, or a bridge. In some example embodiments, the transceiver **605** receives the data from a first device and transmits the data to a second device. In some example embodiments, the first and second devices are connected via a network. In some example embodiments, the coil **603** is used to provide power and the data to a proximate device.

FIG. **7** is a block diagram of an example system **700** representing a mobile computing device used to transfer and receive data to an additional device, where authentication takes the form of placing the device in proximity to the additional device. The various blocks shown herein may be implemented in software, hardware, or firmware. These blocks may be operatively connected, where operatively connected includes a physical or logical connection. Shown is a processor **701** operatively connected to a memory **702**. The memory **702** is in communication with the central processor **701**, the memory **702** including logic encoded in one or more tangible media for execution and when executed operable to transmit a credential to a proximate first device, the first device validating the credential. The logic may also be executed to transmit data to the first device. Additionally, the logic may be executed to transmit the credential to a proximate second device, the second device validating the credential and to receive the data from the first device. In some example embodiments, the credential is used to subsequently access a user profile. In some example embodiments, proximate includes a range of 0 to 4 centimeters. In some example embodiments, the credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value. In some example embodiments, the first and second devices are part of the same local area network.

FIG. **8** is a flow chart illustrating an example method **800** used to transfer and receive data, to/from an additional device, where authentication takes the form of placing the device in proximity to the additional device. Operations **801**-**803** may be executed as part of the command logic module **522**. Operation **801** may be executed to transmit a credential to a proximate first device, the first device validating the credential. Operation **802** is executed to transmit data to the first device. Operation **803** is executed to transmit the credential to a proximate second device, the second device validating the credential and to receive the data from the first device. In some example embodiments, proximate includes orange of 0 to 4 centimeters. In some example embodiments, the credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value. In some example embodiments, the first and second devices are part of the same local area network. In some example embodiments, the data is transmitted using at least one of a BLUETOOTH™ protocol, or an 802.11 protocol.

FIG. **9** is a dual-stream flowchart illustrating an example execution of the verification logic module **522** that facilitates the transfer and receiving of data, to/from a mobile computing device, where authentication takes the form of placing a mobile computing device in proximity to another device. Shown are operations **901-906** that are executed by the mobile computing **110**. Also shown are operations **907-916**, and the verification transmit logic module **526**. These operations **907-916**, and the verification transmit logic module **526** may be executed by a mobile computing device **405** or other suitable device. Operation **901** is executed to initiate a session with a device. A session may be a set up session that uses a tow-range transport medium **202**. Operation **907** is executed to receive a session initiation message. Operation **908** is executed to identify capabilities of the devices participating in the session. Operation **909** is executed to transmit an acknowledgment and the selected transport common to the devices participating in the session. Operation **902** is executed to receive the acknowledgment and transport ID. The transport ID may be described using a Session Initiation Protocol (SIP), a Session Description Protocol (SDP), or other suitable protocol. Transports associated with the transport ID may include: an inductive link, MD, BLUETOOTH™, or some other suitable transport medium. Operation **903** may be executed to transmit a credential to a device. Operation **903**, when executed, may retrieve a symmetric key, asymmetric key, hashed value, and/or value to be processed as a check sum, as a credential **203**. Decision operation **910** is executed to determine whether the credential **203** is valid. In cases where decision operation **910** evaluates to "false" an exit condition **911** is triggered. In cases where decision operation **910** evaluates to "true" the verification transmit logic module **526** is executed, Verification transmit logic module **526** is executed and the verification of the mobile computing device transmitted. Operation **904** is executed to receive the verification form the mobile computing device. Operation **905** is executed to identify a transport on which the data **205** may be transmitted. This transport may be WiFi, GSM, CDMA, UMTS, or some other suitable transport medium. Operation **906** is executed to transmit the data **205** on the transport. Decision operation **913** is executed to determine whether a device is proximate. In cases where decision operation **913** evaluates to "false", an operation **915** is executed. In case where decision operation **913** evaluates to "true", an operation **914** is executed. Operation **915** is executed to set a credential to be invalid, where the mobile computing device is no longer proximate. Operation **914** is executed to process data. Operation **916** is executed to query additional data using the selected transport.

FIG. **10** is a tri-stream flowchart illustrating an example execution of the verification logic module **522** that facilitates the transfer and receiving of a credential amongst three devices. Shown are operations **1001-1007** that are executed by the mobile computing **110**. Also shown are operations **1008-1009** that are executed by another device. Further, shown are operations **1010-1011** that are executed by a further device. Shown is a decision operation **1001** that is executed to determine whether devices are proximate. In cases where decision operation **1001** evaluates to "false" a termination condition is executed. In cases where decision operation **1001** evaluates to "true", an operation **1002** is executed. Operation **1002** is executed to transmit the credential of this device to another device. Decision operation **1008** is executed to determine whether the received credential is valid. In cases where the decision operation **1008** evaluates to "false" a termination condition is executed. In cases where decision operation **1008** evaluates to "true" an operation **1009** is executed. Operation **1009** is executed to transmit a verification and credential "C" for this device. Operation **1003** is executed to receive credential "C". Operation **1004** is executed to store credential "C" into a database **1005**. Decision operation **1006** is executed to determine whether the mobile computing device **110** and another device are proximate. In cases where decision operation **1006** evaluates to "false" a termination condition is executed. In cases where decision operation **1006** evaluates to "true" an operation **1007** is executed. Operation **1007** is executed to retrieve "C" from the database **1005** and to transmit this credential "C". Decision operation **1010** is executed to verify "C". The verification of "C" can take the form of matching two symmetric key values, processing two asymmetric key values (i.e., a public and private key), de-hashing/reverse hashing the credential "C", passing "C" through a check sum algorithm, or some other suitable method of verification. In cases where decision operation **1010** evaluates to "false" a termination condition is executed. In cases where decision operation **1010** evaluates to "true", an operation **1011** is executed. Operation **1011** is executed to establish a session to transmit data between this device and the device from which "C" originated. FIG. **4** illustrates an example execution of the verification logic module **522** of FIG. **9**.

FIG. **11** is a flow chart illustrating an example execution of the verification transmit logic module **526**. Shown are operations **1101-1107** that are executed by the wireless router **401**. Further, shown are operations **1108-1111** that are executed by devices such as the printer **302**, monitor **403**, the laptop computer **404**, and mobile computing device **405**. Decision operation **1101** is executed to determine whether to transmit the credential "C". This credential is received from a mobile computing device **110**. In cases where the decision operation **1101** evaluates to "true" a decision operation **1108** is executed. In cases where the decision operation **1101** evaluates to "false" an operation **1102** is executed. Decision operation **1108** is executed to determine whether the credential is valid. In cases where decision operation **1108** evaluates to "false" a termination condition **1109** is executed. In cases where decision operation **1108** evaluates to "true" an operation **1110** is executed. Operation **1102** is executed to transmit a verification request to a requesting device. Operation **1110** is executed to transmit an acknowledgment and to set a session with a device based upon a common transport. Operation **1103** is executed to receive an acknowledgement and common transport information. This transport may be WiFi, GSM, CDMA, UMTS, or some other suitable transport medium. Operation **1104** may be executed to establish a session using the device using the common transport. Operation **1105** is executed to transmit/receive data using the common transport. Operation **1111** may be used to transmit/receive data using this common transport Decision operation **1106** may be executed to determine whether a device is proximate. In cases where decision operation **1106** evaluates to "true" an operation **1105** may be executed. In cases where decision operation **1106** evaluates to "false" a termination operation **1107** may be executed.

FIG. **12** is a flow chart illustrating an example method to execute operation **910**. Shown are operations **1201-1207**. These various operations may be organized as a series of case statements or conditional statements such that one or more factors of authentication (see decision operations **1201-1205**) may be used. Decision operation **1201** determines whether a valid private key has been provided. Example private key authentication standards and algorithms include the Advanced Encryption Standard (AES), Blowfish, the Data Encryption Standard (DES), Triple DES, Serpent, and Twofish. In cases where decision operation **1201** evaluates to "false" a termination condition **1206** is executed. In cases where decision operation **1201** evaluates to "true" a decision operation **1202** is executed. Decision operation **1202** determines whether a valid public key has been provided. Example public key authentication standards and algorithms include Paillier, Rabin, Rivest, Shamir and Adleman (RSA), Okamoto-Uchiyama, Schnorr. In cases where decision operation **1201** evaluates to "false" a termination condition **1206** is executed. In cases where decision operation **1202** evaluates to "true" a decision operation **1203** is executed. Decision operation **1203** determines whether a valid hash value has been provided. Example hash algorithms include the Message-Digest Algorithm (MD) 5, Secure Hash Algorithm (SHA)-1, and SHA-2. In cases where decision operation **1203** evaluates to "false" a termination condition **1206** is executed. In cases where decision operation **1203** evaluates to "true" a decision operation **1204** is executed. Decision operation **1204** determines whether a valid check sum value has been provided. In cases where decision operation **1204** evaluates to "false" a termination condition **1206** is executed. In cases where decision operation **1204** evaluates to "true" a decision operation **1205** is executed. Decision operation **1205** determines whether a valid finger print has been provided. A valid finger print may be determined via an algorithm including a pattern identifying algorithm. In cases where decision operation **1205** evaluates to "false" a termination condition **1206** is executed. In cases where decision operation **1205** evaluates to "true" an operation **1207** is executed and a valid value returned denoting that the credential **301** is valid.

In the foregoing description, numerous details are set forth to provide an understanding of the present invention. However, it will be understood by those skilled in the art that the present invention may be practiced without these details. While the invention has been disclosed with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover such modifications and variations as fall within the "true" spirit and scope of the invention.

What is claimed is:

**1**. A method comprising:

transmitting a first credential from a mobile device to a proximate first device, the first device validating the first credential;

receiving, at the mobile device, a second credential from the first device; and

transmitting the second credential from the mobile device to a proximate second device, the second device to, upon validating the second credential, establish a session to exchange data with the first device.

**2**. The method of claim **1**, wherein proximate includes a range of 0 to 4 centimeters.

**3**. The method of claim **1**, wherein the first credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value.

**4**. The method of claim **1**, wherein the first and second devices are part of a same local area network.

**5**. The method of claim **1**, wherein the data is transmitted directly between the first and second devices.

**6**. A mobile-computing device comprising:

at least one hardware processor;

a memory in communication with the at least one hardware processor, the memory including logic encoded in one or more tangible media for execution and when executed operable to:

transmit a first credential to a proximate first device, the first device validating the first credential;

receive a second credential from the first device; and

transmit the second credential to a proximate second device, the second device to, upon validating the second credential, establish a session to exchange data with the first device.

**7**. The mobile-computing device of claim **6**, wherein the first credential is used to subsequently access a user profile.

**8**. The mobile-computing device of claim **6**, wherein proximate includes a range of 0 to 4 centimeters.

**9**. The mobile-computing device of claim **6**, wherein the second credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value.

**10**. The mobile-computing device of claim **6**, wherein the first and second devices are part of a same local area network.

**11**. The method of claim **1**, further comprising:

transmitting the data between the first and second devices via the mobile device.

**12**. The method of claim **1**, wherein the first device is to transmit the second credential to the mobile device in response to validating the first credential.

**13**. The method of claim **1**, further comprising:

terminating the session in response to a determination that the mobile device is not proximate to at least one of the first device and the second device.

**14**. The mobile-computing device of claim **6**, wherein the first device is to transmit the second credential to the mobile-computing device in response to validating the first credential.

**15**. The mobile-computing device of claim **6**, the logic further operable to:

terminate the session in response to a determination that the mobile-computing device is not proximate to at least one of the first device and the second device.

**16**. A computer program product comprising:

a tangible computer-readable medium having program code recorded thereon, said program code comprising:

program code to transmit a first credential from a mobile device to a proximate first device, the first device validating the first credential;

program code to receive, at the mobile device, a second credential from the first device; and

program code to transmit the second credential from the mobile device to a proximate second device, the second device to, upon validating the second credential, establish a session to exchange data with the first device.

**17**. The computer program product of claim **16**, wherein the first credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value.

**18**. The computer program product of claim **16**, wherein the first and second devices are part of the same local area network.

**19**. The computer program product of claim **16**, further comprising:

program code to transmit the data between the first and second devices via the mobile device.

**20**. The computer program product of claim **16**, further comprising:

program code to terminate the session in response to a determination that the mobile device is not proximate to at least one of the first device and the second device.

**21**. An apparatus comprising:

means for transmitting a first credential from a mobile device to a proximate first device, the first device validating the first credential;

means for receiving, at the mobile device, a second credential from the first device; and

means for transmitting the second credential from the mobile device to a proximate second device, the second device to, upon validating the second credential, establish a session to exchange data with the first device.

**22**. The apparatus of claim **21**, wherein the second credential includes at least one of a private key, a public key, a hash value, a digital representation of a finger print, or a check sum value.

**23**. The apparatus of claim **21**, wherein the first and second devices are part of a same local area network.

**24**. The apparatus of claim **21**, further comprising:

means for terminating the session in response to a determination that the mobile device is not proximate to at least one of the first device and the second device.

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